

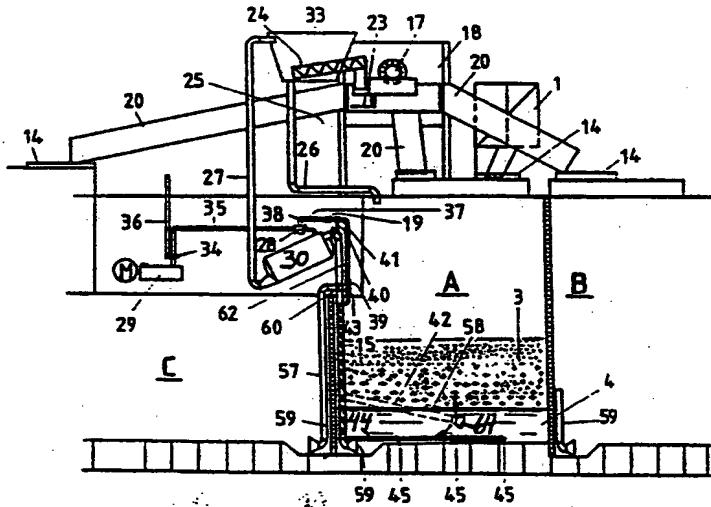
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(71)(72) Applicant and Inventor: RØNNEBERG, Asbjørn [NO/NO]; N-6030 Langevåg (NO).			
(74) Agent: A/S BERGEN PATENTKONTOR; Strandgt. 191, N-5000 Bergen (NO).			
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(54) Title: METHOD AND ARRANGEMENT FOR KEEPING A MAGAZINE OF ICE CUBES AND LIQUID IN A LOOSE AND LUMP-FREE CONDITION



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5      **METHOD AND ARRANGEMENT FOR KEEPING A MAGAZINE OF ICE CUBES  
AND LIQUID IN A LOOSE AND LUMP-FREE CONDITION.**

The present invention concerns a method and an arrangement for keeping a magazine of a mixture of ice 10 cubes and a liquid, such as water, in a loose and lump-free condition. The invention also concerns the above-mentioned arrangement integrated in an arrangement designed to collect and transport the ice cubes to an application processing area. The present invention is especially concerned with plants for producing and storing ice for 15 industrial purposes. One is in this context primarily thinking of food articles, and especially fisheries, such as ocean fisheries, where a catch consisting of fish, shellfish, etc., must be refrigerated by ice in order to 20 preserve its quality.

The ice for which the invention is intended to be used in relation to, can either be brought along from ashore in a separate hold on board, or the vessel can have its own ice machine installed, which produces the necessary ice from seawater. The present invention shall in the 25 ensuing be described in connection with the mentioned sea water ice machine, but shall not limit itself to this.

At present there are several refrigeration systems in operation on board fishing vessels. One of these is the so called RSW-system (Refrigerated Sea Water), which involves that seawater is chilled in a separate unit, and 5 when the catch of fish is taken onboard from e.g. trawl or seine, the chilled seawater is added so that the fish is kept refrigerated. This system, however, has one great disadvantage when the fish dies, its osmotic qualities cease, i.e. the quality that separates the salt from the 10 water when the fish is alive. This quality causes the meat in seawater fish to taste basically unsalted, but when the osmosis ceases the salt will penetrate the fishmeat and make it taste salt, and this will in turn result in a deteriorated quality of the fish.

15 Also the fodder producers who manufacture fish meal for the breeding industry, using fish raw materials, demand that the fish meat should be without salt. For such raw materials it is therefore necessary to use ice refrigeration.

20 Ice may be manufactured from fresh water in conventional ice machines located on board the vessel. This, however, means that the fresh water must be brought from ashore, and also that the vessel must be equipped with a storage tank with a grab device for collecting the ice, as 25 well as ice screws for transporting the ice to the processing area on board. Another disadvantage is that it is impossible to chill fresh water to the same degree as seawater.

30 Another and major problem will arise as a consequence of the fact that ice cubes have a lower specific weight than water or seawater, which will cause the ice cubes to float, forming a layer on the surface of the water. If a supply of ice cubes and water is kept stagnate for a longer period of time, this will result in the ice 35 cubes clogging up or freezing into big flakes or cakes which are quite difficult to handle.

As far as the handling of ice in a magazine is

concerned, one is dependent on the ice having the appropriate compactness and size division, to obtain an adequate dosing into the ice screws, using the grab, an accomplishment almost impossible to achieve in a rational 5 way if the ice is clogging. The plants will therefore be expensive, they are space-consuming and involve large maintenance costs.

To some extent ice in bulk is used together with 10 fresh water from ashore based plants. The ice is refrigerated and a number of magazines on board are filled with a mixture of fresh water and ice, typically up to 15% of the loading capacity. This is both time consuming and expensive, and many vessels, in order to comply with the 15 requirements from the authorities (Veritas), must run with full tanks. Normally there will be water in one tank and ice in the others. The ice, however, will clog as soon as it comes into contact with water in each tank when loading 20 the raw material. It is therefore apparent that also this system for manufacturing ice for refrigerating purposes, also entails big disadvantages.

In the ice machines based on sea water, one obtains 25 fresh water ice and a water portion which is strongly enriched by salt, and the salt water portion is disposed of. These machines are not very often found on board the vessels. One of the reasons for this, is that salt water 30 ice machines are less effective, as the ocean water often has a temperature of up to 10 °C, and a lot of the coldness from the refrigeration device in the ice machine is needed to reduce the seawater temperature down to 0 °C before the actual refrigeration process can start. It is 35 also hard to avoid the storing problems in the ice bins, as mentioned above, concerning the clogging and the difficulties in obtaining an adequate dosing of finely portioned ice particles for the fish raw material.

In consequence, the purpose of the present invention is to introduce a procedure and an arrangement which will 35 totally eliminate the above mentioned problems with

clogging of ice cubes into big cakes in the magazine on board fishing vessels.

5 A further purpose of this invention is to design the arrangement in such a way that it can be incorporated in an already existing fish handling application, which in this case also may be used for collecting ice cubes for transporting them to a processing area.

10 According to the invention, the procedure of keeping a magazine of a mixture of ice cubes and liquid, like water, in a loose and lump free condition, is characterized by the procedure that the magazine of ice and water mixture is subjected to a physical mixing influence, bringing the ice cubes and liquid into strong motion.

15 According to the preferred embodiment, the mixing influence is achieved by injecting a fluid into the magazine, thus creating fluid bubbles which will affect the mixing motion. The fluid is preferentially injected in pulses with time intervals, preferably with regular time intervals of approximately 1 - 3 hours, the optimal time 20 interval being 3 hours. The fluid is injected in a horizontal direction and/or in a vertical direction from the bottom of the magazine.

25 Preferentially the fluid will be injected through a pipe applied in the bottom area of the magazine, and into the magazine, through a number of outlet nozzles in the pipe. The fluid is injected into the magazine through a number of branch pipes which are spread over the magazine bottom area, in that each branch pipe contains a number of outlet nozzles for the fluid. Three such branch pipes can 30 be applied.

In the present case the liquid is seawater and the fluid is air.

35 It is also generally seen possible to achieve the effect of a mixing influence by using other means, such as mechanical agitators or similar devices, but in the present invention one prefers to use fluid injection, e.g. using air or a liquid such as sea water, where the salt

content can be approximately 3%.

According to the present invention the arrangement for keeping ice cubes in a liquid in a loose and lump-free condition in a magazine, is characterized by a pipe with a 5 number of outlet nozzles being applied in the magazine containing the mixture of ice cubes and liquid, and this pipe is connected to a pumping device through a supply pipe, in that the pumping device is designed to inject a fluid through the pipe, through the outlet nozzles and 10 into the magazine.

According to one preferred embodiment, the pipe is applied in the lower part of the magazine, and preferably at the bottom portion of the magazine. By preference the pipe comprises a number of separate branch pipes, which 15 from the branching point are spread over the bottom area of the magazine, and each branch pipe comprises a number of outlet nozzles for injecting the fluid.

According to another preferred embodiment, the arrangement, according to the invention, comprises control 20 organs for injecting the fluid alternately from the branch pipes.

According to an especially preferred embodiment, the arrangement, according to the invention, as described before, is integrated in an existing arrangement known per 25 se for collecting ice from the magazine and transporting it to a processing area through a rising pipe, where an intermediate storage tank is included in the rising pipe, and where the intermediate storage tank by means of a pressure transmitter in succession can:

- 30 a) be subjected to vacuum in order to suction a volume of the ice/water mixture from the magazine through the pipe and into the tank,
- 35 b) whereafter the tank can be subjected to over-pressure to force the ice/water mixture further through the pipe and on to the processing area, and this embodiment the arrangement is characterized by a separate pipe to injecting fluid to the magazine.

The collecting arrangement is further modified by the pipe constituting a separate injection pipe in the magazine, while the rising pipe constitutes a separate suction pipe, and the injection pipe and the suction pipe 5 is being arranged in proportionally different height levels in the magazine.

In this context the term 'processing area' means that the ice/water mixture is transported to a dosing machine of a fairly well-known type, where the ice cubes, 10 after being separated from the sea water, will be evenly dosed in suitable amounts together with the fish that is being removed from the trawl or seine.

As far as the specified features of the arrangement, as outlined in the invention, are concerned, one refers to 15 the subsequent dependent claims 8-18.

In one of these preferred embodiments the arrangement comprises means for controlling the mixing influence and the suction process in such a way that the following stages are carried out consecutively:

- 20 1) injection of fluid into the magazine,
- 2) suction of an ice/water mixture from the magazine into the tank from the magazine by subjecting the tank to vacuum, and
- 3) pressing the ice/water mixture to the surface by subjecting the tank to over-pressure.

The present invention shall in the following be described in detail, with reference to the enclosed drawings, wherein:

30 Fig. 1 shows a sectional drawing of a plant for producing ice on board a vessel.

Fig. 2 shows another section of the same plant and illustrates a combined arrangement, for producing the mixing influence for the ice/saltwater mixture, and for extracting ice/saltwater to the processing area.

35 Fig. 3 and 4 show a schematic outlines of different designs for arranging a fluid injection pipe with three branch pipes in a magazine.

In as far as the arrangement for the present invention normally (e.g. on board a vessel with limited space) would be integrated with an ice machine, shall the ice machine also be described in relative detail in the following description.

Fig. 1 shows an ice plant, as on board a vessel with a deck D and an engine room M where a refrigeration device 8 is located, a hold 3 which functions as an ice magazine, and a hold L for the fish. The bottom of the vessel is marked B, and is also described as a tank top 21. The holds are separated by isolated partition walls V.

An ice machine 1 is positioned on the deck, for instance an ice machine which produces tube ice or plate ice, and it delivers the ice in free fall down into the magazine 3,4. The refrigerator 8 produces chilled sea water which, by means of the pump 11, is pumped up from the seawater source 22 below the vessel. The water is carried through the refrigerator 8 to the magazine 3,4, which consists of a mixture of ice cubes (from the ice machine 1) and salt water. During standstill the ice 3 floats up due to lower specific weight, and forms a layer on the surface of the salt water 4, like the figure shows. From the bottom of the magazine 3,4, the suction/feed pump 5, suctions salt water 4 through a pipe 32, and this salt water 4 is carried into the condenser of the ice machine through the valve/pipe 6, and also through the valve/pipe 7 to the ice machine 1.

To convey the ice 3 through to the processing area, e.g. for the purpose of refrigerating fish in another hold on the vessel, the magazine tank has been equipped with a conveyor/rising pipe 42/15. The conveyor system for ice is additionally designed as described in connection with figure 2.

Each of the holds A, B, C of the vessel have a countersunk well 16 in the bottom B for the purpose of complete drainage of residue water from the holds. Drainage water is sucked out of the well 16 through a pipe 59.

Also downwards into the bottom of the ice magazine tank, a pipe 59 is arranged.

Figure 1 shows that the ice 3 and the salt water 4 are phase separated into two main layers, but it will be evident from the following description that when ice is taken out from the magazine 3,4, the magazine is first subjected by the mixing influence a loose and lump free mixture of ice cubes and water, so that a mixture of ice 3 and salty water 4 can be pumped up to the deck D.

From the bottom of the magazine 3,4 a possible water outlet is guided through a pipe 10 into the refrigerator 8, for instance, in the case of heat exchanging, to be used for precooling of the sea water which is pumped in from the source 22. This outlet water is discharged through a pipe 12 with valve back to the sea. A grate is arranged in front of the outlet pipe.

The plant further consists of a set of temperature sensors 13 in the tank, which record the temperature in the different horizontal layers of the magazine 3,4.

With this plant it is now possible to easily adjust the ice production, according to the immediate need for ice in the processing area. The level in the magazine 3,4 can be further controlled by adjusting the pumps 11 (sea water in) and 12 (salt water out). Furthermore it is now possible to make very effective use of the capacity of the ice machine, since use is made of sea water, which has been precooled to approximately 0 °C in the RSW-unit, is fed directly into the ice machine. This makes it possible to increase the ice production by almost 20%.

In figure 2 is shown in detail, according to the invention, the specific system which produces the mixing influence in the magazine with the mixture of ice cubes and water, as well as, according to the invention, a system for transporting a mixture of ice cubes and water to a processing area.

Figure 2 shows the ice machine 2 which delivers ice to hold A as described previously. On each side of this

hold, hold sections B and C have been arranged, for storing fish refrigerated by ice from hold A.

A mixture of ice 3 and salt water 4 is sucked through the pipe 15 and into an intermediate storage tank 30 and squeezed or pressed further through the pipe 27 to a feeding tank 33 for ice, with the help of the pressure transmitting from a compressor or pump 29. The intermediate storage tank 30 is moreover arranged in a tilted position, so that its outlet side is positioned at a lower level than its inlet side, in the vertical direction. In the feeding tank 33 the salt water runs off the ice and is carried through the pipe 26 back to the magazine 3,4. The ice is conveyed further by a transport screw 24, (or possibly a conveyor belt) up to a dosing unit 18 for delivery to a dosing plate 23, while the fish intended for refrigeration is transported from the feeding unit 17 from a seine or a trawl. From the dosing plate 23 the fish/ice mixture is guided into distribution ducts 20 for transport to the relevant holds.

A pipe 35, which is connected between the pump/- pressure transmitter 29 and the pipe 15, contains in succession:

- a) a branching to an outlet 36 to the surroundings through a shift valve 34 (4-ways) which when shifting in succession can produce pressure and vacuum in the pipe 35 by means of the pressure transmitting function of the pump 29,
- b) a reversing valve 28 from where the pipe 35 branches into:
  - one first branch pipe 37 which leads into a further branch point 41 which includes a 3-way shift valve, and a second branch pipe 38 which leads into the inlet side of the tank 30.

From the branching point 41 a pipe 40 leads down to the bottom of the magazine, and leads further by a more or less horizontal section 44 into the magazine 3,4. The horizontal section is designed with a number of outlet

nozzles 45 from where the fluid is injected into the magazine 3,4.

Furthermore, from the branching point 41 with the 3-ways valve, a pipe 62 connects to the pipe 15 at a given 5 distance from the floor of the magazine. Upstream of the inlet of the pipe 15, the pipe 62 contains a manifoil 39 and a back pressure valve 43.

10 The valve 34 has been designed in such a way that when the pump 29 with strong pressure blows fluid through the pipe 36, this will entail a simultaneous strong suctioning vacuum in the pipe 35.

15 Fig. 3 shows a horizontal section of a preferred arrangement of the injection arrangement. From the inlet at the bottom of the magazine 3,4 the pipe 40 branches out into three branch pipes 46, 47, 48 which are distributed so that they cover a large area of the floor of the magazine. The branch pipes comprise the valves 51, 52, 53, 54, 55, and these can be controlled during injection so that the fluid is injected alternately from the nozzles 45 20 in the three branch pipes.

25 Fig. 4 shows an alternative design of the positioning of the branch pipes in the bottom of the magazine. It follows that from the connection point 70 three branch pipes 72, 74, 76, each with an outlet nozzle on the end, branch out over the floor of the magazine. The pipe 74 is positioned furthest off inwards in the magazine seen from the branching point 70, while the pipe 72 is positioned nearest. This positioning is suitable when the bottom of the magazine has a rectangular floor area, as shown in the 30 figure. The control of the alternate injection through the three pipes is achieved in the same way as described in fig. 3.

35 In the magazine the rising pipe 15 comprises a suction pipe in the form of a flexible hose 42 which from a distance over the floor level of the magazine 3,4, extends more or less horizontally inwards into the magazine 3,4. The hose 42, at the inlet 57 to the magazine 3,4, forms a

## 11

hinge connection, in the shape of a flange, so that the hose can be tipped upwards and downwards round a horizontal axis. The hose 42 further comprises a float gadget 58 to enable it to float in the water in the boarder area 5 between the ice layer 3 and the water 4. In this way the hose 42 always floats in a position close to the ceiling of the ice substance (seen from below), and the height position of the hose will always vary upwards and downwards (see arrows on fig. 2) in pace with the changing 10 height level of the boarder area, depending on the volume of the magazine. When suctioning ice/liquid through the opening 64 of the hose 42, one is ensured to obtain a suitable mixture of water and ice. The mixture will in this boarder area be adequately suction- and pump-able.

15 Any residue water in the tank may be emptied by connecting the pipe 59 to the rising pipe 15 within a suction step.

20 When fluid is injected into the magazine 3,4, the valves 34, 28 and 41 are adjusted so that the fluid is carried through the pipes 35, 37, 40 and 44 up until and into the magazine 3,4, through the injection nozzles 45. If desired, the injection may also be arranged through the pipe 15, by adjusting the valve 41 to injection through the pipe 62, further into the pipe 15 and into the magazine 3,4 through the suction opening 64 on this pipe 62. 25 Injection through the pipes 62 and 15 may also be relevant when the unit is used for pumping fish, in order to blow out fish which might be stuck in the pipe 15 during the suction process.

30 It has been found that the above mentioned high pressure pulse of fluid, which preferentially is air, forms air bubbles which make the magazine 3,4 "boil" during a vigorous stirring.

35 In accordance with an optional embodiment, water, for example sea water from the magazine 3,4, may be injected into the magazine instead of air. This may for example be effected by suction of a volume of water 4 from the

magazine and into the pipe 42, 15 and thereafter re-injecting it back into the magazine with a powerful over-pressure.

At an optional time thereafter, e.g. 2 seconds after

5 the injection, the valves 34, 28, 41 readjust, so that a strong vacuum builds up in the pipes 35, 38, 15, which will discharge the ice/water mixture in through the opening 64 to the horizontally positioned hose 42 and further up through the pipe 15 and into the tank 30. During this

10 part of the process the pipe 62 is shut down by means of the reversing valve 43, to stop ice and water from penetrating into the fluid injection pipes 37 and 62. The valve 41 will close to prevent suction effect in the injection pipe 40.

15 When the tank 30 is filled with a mixture of ice cubes and water, the valves 34 and 28 will readjust so that the full fluid pressure from the pump 29 is guided into the back side of the ice/water in the tank 30, i.e. through the pipe 38 to the inlet side of the tank, and in

20 consequence the said ice/water content is squeezed out of the tank 30 and into the rising pipe 27 all the way to the feeding tank 33 where the water runs off the ice and is carried through the pipe 26 back to the magazine.

How a possible water surplus in the magazine 3,4 can

25 be carried away, is indicated in figure 1 with attached text.

One pipe 15 (of the pipes 40, 15) which can carry pressure fluid to the magazine 3,4 constitutes, according to a preferred embodiment of the invention, the same pipe

30 that the ice/liquid mixture is suctioned into from the magazine 3,4 to be carried to the processing area, something that is achieved by readjusting of the said valves.

The control of these valves, in order to achieve all steps of fluid injection, suction of ice/water, and the

35 distribution of the fluid injection through the previously mentioned branch pipes 46, 47, 48, will be carried out automatically, by means of a computer system.

Summarized, the process of the mixing influence and the suction process of the invention, include these steps in consecutive order:

- 1) blowing air into the magazine,
- 5 2) suctioning an ice/water mixture into the tank 30 from the magazine, and
- 3) conveying the ice/water mixture to the surface by subjecting the tank 30 to over-pressure.

With a continuous demand for ice on deck D, this 10 cycle will be carried out with injection of fluid (air) at suitable time intervals, while the suction of the ice/-water mixture may take place any chosen number of times after each injection. Normally it will be enough to inject fluid every 3 hours.

15 For long periods on board, however, there will be no need for ice supply from the magazine 3,4. If the ice in the magazine 3,4 is kept stagnant too long, phase separated in the layer 3, the clogging of the ice particles will increase to form larger lumps. According to the invention, 20 it is therefore preferred, when there is no immediate need for ice, to discharge a pulse of compressed air approximately once every hour, to keep the aggregate of ice and salt water in a loose mixture.

In this way the injection system 29, 35, 15 according 25 to the invention can also be used separately for the sole purpose of keeping an ice/water substance 3,4 in a loose mixture. The extent of the injection will of course be adjusted in accordance with the size of the magazine.

Figure 2 further indicates that the pipe 15 includes 30 a branch pipe 59 (with a two-way shut-off valve 60 in the branching point) to the bottom of the storage tank C. The system according to the invention thus may be used for emptying other tanks on the vessel, e.g. of fish, and that 35 it might give a choice of possibilities regarding which hold the ice magazine at best should be stored in.

EXAMPLE

The arrangement according to the invention was assembled and tested in a fishing vessel.

In the bottom of a storage tank with an ice/sea water magazine with a volume of 100 m<sup>3</sup>, with an ice cube share of approximately 60%, air was injected after a given procedure through three pipes positioned in the bottom of the tank. The air was injected alternately between the three branch pipes, first on one side, then on the other side and finally through the branch pipe in the centre. The air blasts were made in pulses of approximately 5 seconds from each pipe. The injection capacity of the air blasts was 900 m<sup>3</sup> air per hour. The complete injection cycles thus lasted for a total of 15 seconds with a total amount of air of 6 m<sup>3</sup>. During the air blasting procedure it was visually observed that the mixture of ice cubes and sea water almost boiled as the sea water/air bubbles rose approximately 50 cm over the normal surface level. After the blasting the ice was completely calm after just a few seconds. Injection was carried out every 3. hour.

The injection test showed that the positioning of the horizontal pipe 42 had a decisive effect on the amount of ice that was suctioned.

During the ensuing suction process for ice cubes/sea water, the pressure in the vacuum tank, which was approximately 2000 litres, was reduced to approximately 40% vacuum by means of which the ice/sea water mixture was suctioned up. When the tank 30 was approximately full, pressure was introduced at the inlet side of the tank, and the ice/sea water mixture was pressed up to the deck. While the complete suction/pumping cycles lasted for about 40 seconds, the process of pressing the mixture up to the deck lasted for only 13 seconds. After separating the sea water, the ice cube substance was weighed at approximately 850 kg ice cubes. Since the tank was almost full, this meant that an ice/sea water mixture with an ice-share of approximately 50% had been suctioned up from the magazine.

Judging from this test, the capacity for ice delivery will be approximately 1275 kg ice per minute, equivalent to 76,5 ton per hour. The capacity according to this will be more than adequate for fishing vessels and

5 also for other areas of utilization.

In the case of a loading capacity of approximately 250 ton fish per hour it will according to this be possible to dose up to 30% ice with the above mentioned ice delivery capacity.

10 Based on the present invention one has accordingly produced an ice delivery plant that is compact and which can also be installed on smaller fishing vessels. The plant keeps the ice in a loose and easily dosable mixture with water that is strained away before use, resulting in

15 a product of fresh water ice of a more than adequate quality for keeping the load of fish refrigerated on board the vessel.

20 When the fish that is caught is to be refrigerated in the vessel's storage tanks, the procedure starts with filling the storage tanks with 8 volume% sea water and 8 volume% ice, after which the fish-catch is added, mixed with 8-10% ice cubes. This will result in a more economical and effective refrigeration of fish than with earlier R.S.W-systems. Additionally this will produce an ice/-

25 water/fish mixture which is very easy to pump for the plant, according to the invention. The plant according to the invention is very well suited for use on board vessels as well as for use in ashore based units.

30 All of the draw-backs mentioned at the beginning, which are found in previously known ice supplying systems, have consequently been eliminated by means of the present invention.

P A T E N T   C L A I M S

1. Procedure for keeping a magazine of ice cubes (3) in a liquid (4) in a loose and lump free condition,  
5      characterized by exposing the magazine (3,4) to a physical mixing influence bringing the ice cubes and liquid into strong movement.
- 10     2. Procedure in accordance with claim 1,  
      characterized by achieving the mixing influence by injecting a fluid into the magazine (3,4) for the purpose of creating fluid bubbles which effect the mixing movement.
- 15     3. Procedure in accordance with claim 1 and 2,  
      characterized by injecting the fluid in pulses with time intervals, preferably with regular time intervals of approximately 1 - 3 hours, and most preferably with time intervals of 3 hours.
- 20     4. Procedure in accordance with any of the claims 1 and 2, characterized by injecting the fluid in horizontal direction and/or in vertical direction  
25      from the bottom of the magazine.
- 30     5. Procedure in accordance with any of the preceding claims, characterized by the liquid being sea water and the fluid being air.
- 35     6. Procedure in accordance with any of the preceding claims, characterized by injecting the fluid through a pipe (44) which is arranged in the bottom portion of the magazine, and into the magazine through a number of outlet nozzles (45) in the pipe.

7. Procedure in accordance with any of the preceding claims, characterized by injecting the fluid into the magazine through a number of branch pipes (46, 47, 48) which are distributed over the bottom area of the magazine, in that each branch pipe comprises a number of outlet nozzles (45) for the fluid.

8. Arrangement for keeping ice cubes (3) in a liquid (4) in a loose and lump free condition in a magazine, characterized in that a pipe (44) with a number of outlet nozzles is positioned in the magazine, and the pipe (44) is connected to a pumping device (29) through a feed pipe (35, 37, 40), in that the pumping device (29) is arranged for injecting a fluid through the pipe (44), through the outlet nozzles and into the magazine.

9. Arrangement in accordance with claim 8, characterized by arranging the pipe (44) in the lower portion of the magazine, preferably in the bottom portion of the magazine.

10. Arrangement in accordance with claims 8 and 9, characterized by the pipe comprising a number of separate branch pipes (46, 47, 48) which from a branching point are distributed over the bottom area of the magazine, and each branch pipe comprises a number of outlet nozzles for injecting the fluid.

11. Arrangement in accordance with any of the preceding claims 8 - 10, characterized by control organs for injecting the fluid alternately through the branch pipes (46, 47, 48).

12. Arrangement in accordance with any of the preceding claims 8 - 11, where the arrangement is integrated with an existing arrangement known per se, for collecting ice from a magazine of ice and sea water to a processing area

through a rising pipe (15), where an intermediate storage tank (30) is included in the rising pipe (15), and where the intermediate storage tank (30) by means of a pressure transmitter (29) in consecutive order can:

5 a) be subjected to vacuum in order to suction a volume of the ice/water mixture up from the magazine through the pipe to the tank.

10 b) after which the inlet side of the tank (30) can be subjected to over-pressure to discharge the ice/-water mixture volume further through the pipe (27) to the process area,

characterized by the arrangement comprising a separate pipe (40) for injecting fluid into the magazine (3,4).

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13. Arrangement in accordance with any of the claims 8 - 12, characterized by the pipe (40) in the magazine (3,4) constituting an injection pipe (44), while the rising pipe (15) constitutes a suction pipe (42), and the injection pipe (44) and the suction pipe (42) are arranged in proportionally unequal height levels in the magazine (3,4).

25

14. Arrangement in accordance with claim 13, characterized by the suction pipe (42) being applied in a boarder area between the layers of water and ice cubes.

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15. Arrangement in accordance with claim 14, characterized by the suction pipe comprising a flexible hose (42) which more or less horizontally extending inwards in the magazine, and the hose (42) is arranged to follow a varying height level of the boarder area between ice cubes and water, depending on the volume of the magazine, by means of hinging the hose at the inlet (57) of the magazine (3,4) to enable it to tilt upwards and downwards in relation to the level variations

in the magazine, and that the hose comprises a float gadget (58) to enable it to follow a varying height level of the boarder area.

5 16. Arrangement in accordance with any of the preceding arrangement claims, characterized by the injection pipe being designed as indicated in claim 8 -11.

10 17. Arrangement in accordance with claim 12, characterized by a pipe (35) being connected between the pressure transmitter (29) and the pipe (15), the said pipe (35) comprising in consecutive order:

15 a) a branching to an outlet (36) through a valve (34) which by readjustment, by means of the pressure transmitting function of the pump (29), in consecutive order can produce an over pressure and an vacuum in the pipe (35),  
b) a valve (28), from which the pipe (35) branches out into a branch pipe (37) leading directly into the pipe (40) and further into the magazine (3,4), and a branch pipe (37) leading into the inlet area of the tank (30).

25 18. Arrangement in accordance with the preceding claims, characterized by means for controlling the mixing process and the suction process in such a way that the ensuing stages are carried out consecutively:

30 1) injection of fluid into the magazine,  
2) suctioning an ice/water mixture into the tank (30) from the magazine by subjecting the tank (30) to vacuum, and  
3) pressing the ice/water to the surface by subjecting the tank (30) under over-pressure.

FIG. 1

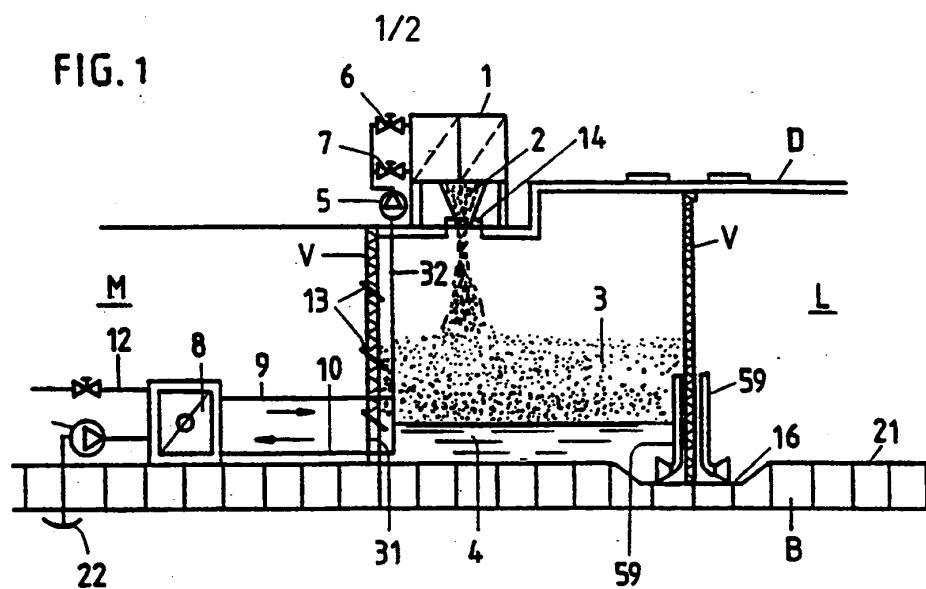
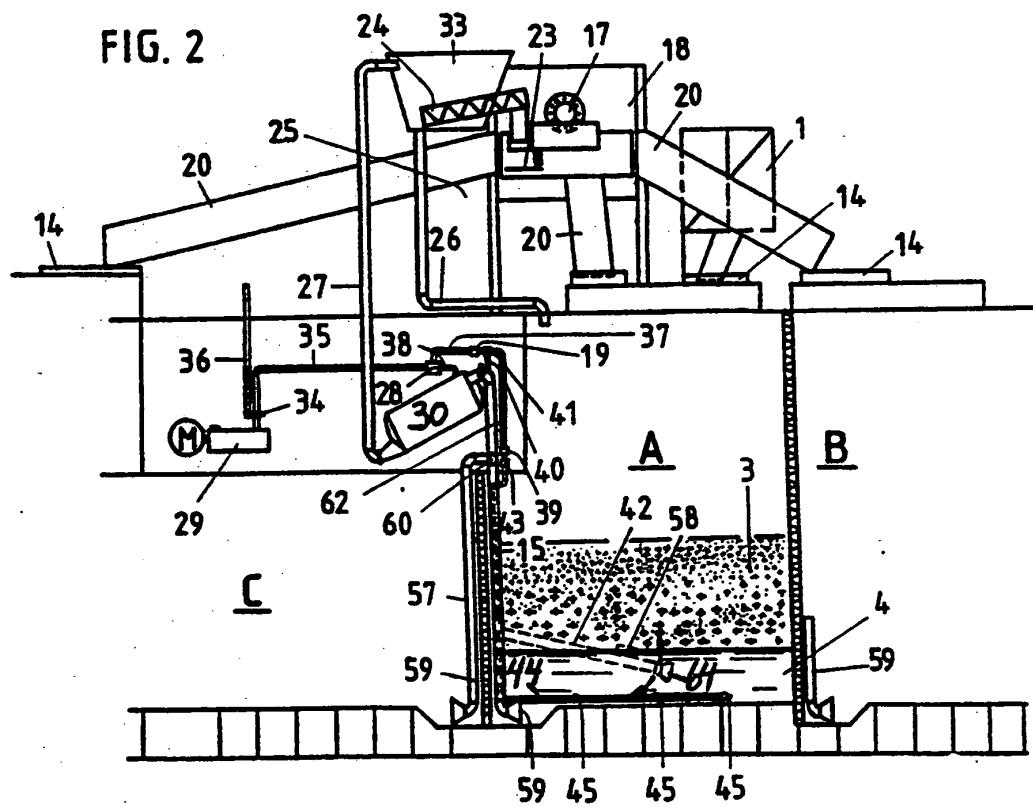


FIG. 2



## **SUBSTITUTE SHEET**

2/2

FIG. 3

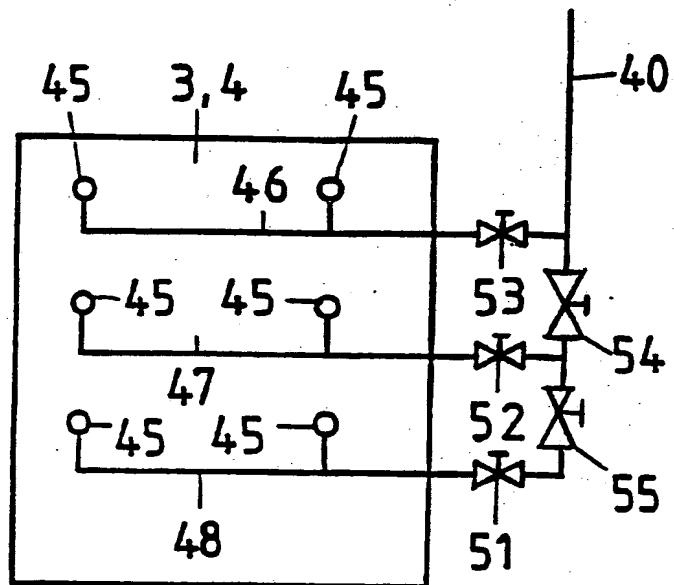
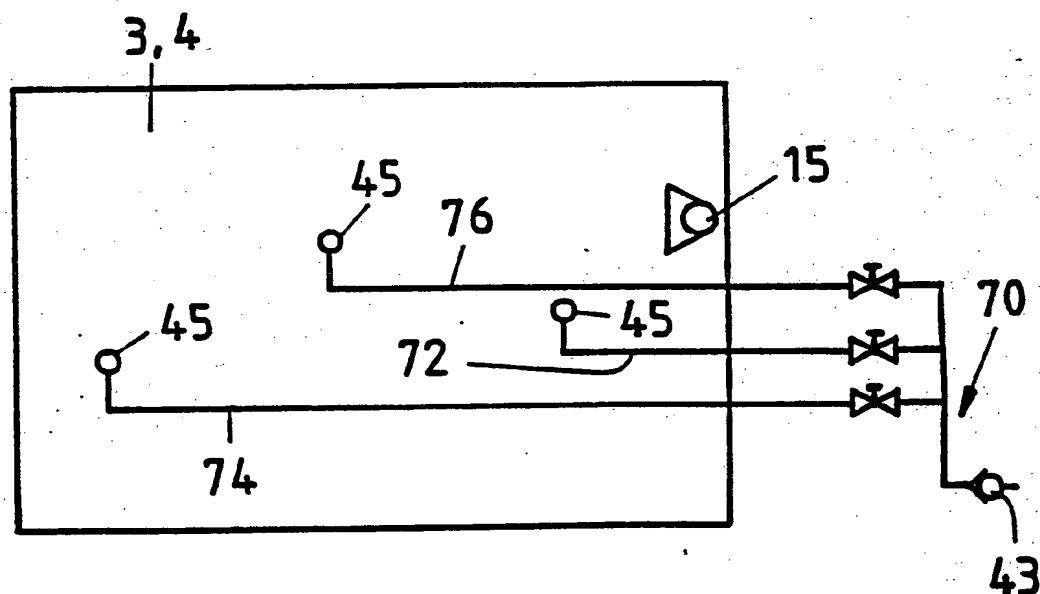


FIG. 4



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 93/00121

## A. CLASSIFICATION OF SUBJECT MATTER

IPC5: F25C 5/18

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: F25C, F25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4901539 (GARBER ET AL), 20 February 1990 (20.02.90), page 4, figure 4 --	1
Y	GB, A, 2225845 (THERMAL ENGINEERING SYSTEMS LIMITED), 13 June 1990 (13.06.90), page 2, line 15 - line 19, figure 1 --	1,2,4,5,6,8,9
Y	WO, A1, 8900668 (SUNWELL ENGINEERING COMPANY LIMITED), 26 January 1989 (26.01.89), page 12 - page 14, figures 12-13 --	1,2,4,5,6,8,9

 Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search

23 November 1993

Date of mailing of the international search report

25 - 11 - 1993

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. + 46 8 666 02 86Authorized officer  
  
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International application No.

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO, A1, 8900382 (SUNWELL ENGINEERING COMPANY LIMITED), 26 January 1989 (26.01.89), page 3, figures 2,3 --	1-18
A	US, A, 3004407 (W.F. MORRIS, JR.), 17 October 1961 (17.10.61) --	1-18
A	NO, B, 853729 (KVAERNER KULDE A/S), 24 March 1987 (24.03.87) --	1-18
A	US, A, 4788830 (SCHREINER ET AL), 6 December 1988 (06.12.88) --	1-18
A	US, A, 4881378 (BRYANT), 21 November 1989 (21.11.89) --	1-18
A	US, A, 3447338 (H.L. SMITH, JR.), 3 June 1969 (03.06.69) -- -----	1-18

## INTERNATIONAL SEARCH REPORT

Information on patent family members

01/10/93

International application No.

PCT/NO 93/00121

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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GB-A- 2225845	13/06/90	NONE		
WO-A1- 8900668	26/01/89	AU-A- EP-A- JP-T- US-A- US-A-	2251788 0375701 3500806 4912935 5035733	13/02/89 04/07/90 21/02/91 03/04/90 30/07/91
WO-A1- 8900382	26/01/89	AU-A- DE-A- EP-A- EP-A, B- SE-T3-	2074088 3879219 0320026 0382730 0382730	13/02/89 15/04/93 14/06/89 22/08/90 ()
US-A- 3004407	17/10/61	NONE		
NO-B- 853729	24/03/87	NONE		
US-A- 4788830	06/12/88	NONE		
US-A- 4881378	21/11/89	NONE		
US-A- 3447338	03/06/69	BE-A- NL-A-	675032 6600257	12/07/66 18/07/66

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